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Lateral changes of seismic anisotropy in the upper mantle around the Northern Apennines

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We performed three-dimensional analysis of anisotropic parameters of body waves to develop a 3D self-consistent dynamic model of the syn-convergent extension in the Northern Apennines within the multidisciplinary project RETREAT. Simultaneous extension within the convergent margin can be the consequence of the retreat of the subducting Adriatic plate from the orogenic front, caused by sub-lithosphere mantle processes that seismic anisotropy can help to decipher. We use data recorded by the RETREAT temporary array consisting of 35 stations complemented by data of permanent INGV observatories. Currently, 18-months of data are available from some stations, representing half of the passive experiment duration. We detect many examples of core-refracted shear-wave splitting within the upper mantle, and observe both distinct lateral variations of anisotropic parameters and their dependence on the direction of propagation. In particular, the fast shear-wave polarization changes from slab-perpendicular to slab-parallel along the Apennines chain. There is also a distinct change in the anisotropic signals across the presumed boundary of the Tyrrhenian and Adriatic micro-plates. Variations of the splitting time delays and orientation of the fast shear waves, together with considerations on the geodynamics of the area, seem to exclude simple sub-lithosphere mantle corner flow as the only source of the observed anisotropy. Alternate models include (1) a frozen-in fabric of different lithosphere domains, and (2) complex mantle flow associated with the Plio-Pleisocene uplift and extension of Tuscany.